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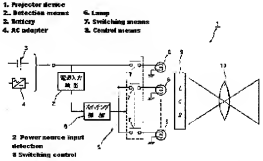
[54] [Title of Invention]
Projector device

[57] [Abstract]
[Subject] To control lamp ignition as a function of the power-source capacity in a projector device
[Constitution] A power-source circuit capable of driving projector device 1 using battery 3 or AC adapter 4 is constructed. Power-source input detection unit 2 is installed to detect the type of battery or the presence of external power-source input and the detection results are sent to lamp ignition control unit 5. Lamp ignition control unit 5, which comprises switching control unit 8 and switches 7, 7 that set the power source that is provided to lamps 6, 6, controls the power of the lamps commensurate with the capacity of the power source to provide power by controlling the number of lamps used or by sequentially switching lamps 6, 6 through pulse width modulation control.



[Scope of Patent Claim]
[Claim 1] A projector device provided with a plurality of lamps installed for backlight, a switching means that determines whether or not power is supplied to each lamp, and a control means that controls said switching means, wherein a detection means that identifies the capacity of the power source to provide power by detecting an AC adapter attached to the projector device, the type of battery and/or the power-source capacity is installed, the control means controls the switching means by receiving a detection signal from the detection means, and the power of the lamps is controlled commensurate with the capacity of the AC adapter or battery power source to provide power by setting the number of lamps used as well as the ignition duration and ignition period of the lamps.
[Detailed Description of the Invention]
[0001]
[Field of Industrial Utilization]
The present invention provides a novel projector device fitted with a plurality of lamps for backlight in which the power of the lamps is controlled commensurate with the capacity of the power source.
[0002]
[Related Art] Frontal-projection projector devices are available that permit a picture to be enlarged for viewing by projection on a screen.
[0003] Among such projector devices, the common device is used indoors with a commercial alternating-current voltage power-source input that fires a large-capacity lamp to project a display image on a liquid-crystal display panel through an optical system.
[0004] In addition, portable projector devices that are used where an external power-source input is unavailable are battery driven.
[0005] However, when projecting a picture using a video camera, the viewing on a sufficiently large display screen of the projected picture that had been captured is desired.
[0006] The ability of the projector device to use a commercial alternating-current power source or batteries is desirable in such a case.
[0007] In short, an AC adapter would be used to provide commercial alternating-current power source voltage when using a projector device indoors since a commercial alternating-current power source is available while a projector device that is used outdoors would best be driven by batteries.
[0008]
[Problems Solved by the Invention] However, when aforementioned projector device is controlled so as to set the brightness of the projector light constant, independent of the power-source capacity of the projector device, the operating duration of the projector device is shortened because of excess battery consumption when a battery without reserve power-source capacity is used for the power source of a projector device.
[0009]
[Means of Solving the Problems]

Thus, the present invention provides a projector device fitted with a plurality of lamps installed for backlight, a switching means that determines whether or not power is supplied to each lamp, and a control means that controls said switching means in order to resolve aforementioned problems, wherein a detection means that identifies the capacity of the power source to provide power by detecting an AC adapter attached to the projector device, the type of battery and/or the power-source capacity is installed, the control means controls the switching means by receiving a detection signal from the detection means, and the power of the lamps is controlled commensurate with the capacity of the AC adapter or battery power source to provide power by setting the number of lamps used as well as the ignition duration and ignition period of the lamps.

[0010]

[Action] An image is projected by a bright backlight when a power source with reserve power is used while power consumption is inhibited to prolong the duration over which the battery can fire the lamp when a low-capacity battery is used since the lamp power is controlled commensurate with the capacity of the power source in the projector device pursuant to the present invention.

[0011]

[Embodiments] The projector device pursuant to the present invention is explained below through the embodiments that are illustrated.

[0012] Figure 1 presents the basic structure of projector device 1. It is structured so as to detect the type of battery or if an external power-source input is being received, and to then control the ignition of the backlight lamp commensurate with the capacity of the power source.

[0013] In the diagram, reference numeral 2 denotes a power-source input detection unit that detects the type of battery 3 or the capacity of the power source fitted to projector device 1, or that detects if power-source voltage is input via AC adapter 4 when power is supplied from a commercial alternating-current power source.

[0014] Reference numeral 5 denotes a lamp ignition control unit that receives the detection results from power-source input detection unit 2 and controls ignition of a plurality of lamps 6, 6 for the backlight.

[0015] This lamp ignition control unit 5 has switches 7, 7 that specifically determine if power is supplied to lamps 6, 6 and switching control unit 8 that controls the switching of these switches 7, 7.

[0016] For example, switching control unit 8 sends a signal to switches 7, 7 to close all switches, thereby igniting all lamps, as shown in Figure 2 (a), when power-source input detection unit 2 detects that a battery with great reserve power-source capacity is fitted to projector device 1 or that power is being received from AC adapter 4, while switching control unit 8 sends a signal to some switches 7, 7 to ignite some lamps commensurate with the capacity of the power source, as shown in Figure 2 (b), when power-source input detection unit 2 detects that a battery with low reserve power-source capacity is fitted to projector device 1, thereby

igniting one lamp, inhibiting the brightness of the backlight, and reducing battery consumption.

[0017] Switching control unit 8 effects PWM (pulse width modulation) control by altering the pulse width of the signal sent to switches 7, 7 in order to avoid the problem of premature lamp exhaustion when only specific lamps are commonly ignited if the battery capacity is low. The brightness of the backlight should be freely altered even while using all lamps (this is explained in detail below).

[0018] Reference numeral 9 denotes a liquid-crystal display panel upon which is displayed a signal from the image signal processing circuit that is not shown. An image is projected to the front via lens 10 after backlight from the rear is illuminated.

[0019] Figure 3 to Figure 8 show the method of detection of the battery type and of the connection of AC adapter 4.

[0020] Figure 3 is an external view of projector device 1 and battery 3. Power-supply terminals 11, 11 are installed in battery 3 near the upper edge of interface surface 3a with projector device 1 while identification projection 12 that shows the capacity of the internal secondary battery or the difference between battery and AC adapter power supply is formed near the lower edge.

[0021] In short, the capacity of the secondary battery can be recognized or the attachment of a battery to projector device 1 or the use of AC adapter 4 can be differentiated depending on where identification projection 12 is formed on interface surface 3a.

[0022] Figure 4 shows an example of the shape of AC adapter 4 that comprises switching power-source unit 13 and adapter unit 14.

[0023] Switching power-source unit 13 houses a switching regulator circuit that converts commercial alternating-current voltage provided through cord 15 fitted with a plug into predetermined direct-current voltage that is output to power-supply terminals 16, 16 of adapter unit 14 via a connecting cord.

[0024] Interface surface 14a of adapter unit 14 and projector device 1 has the same structure as that of aforementioned interface surface 3a of battery 3 except for the position of identification projection 17 that is formed thereupon. Power-supply terminals 16, 16 are installed near the upper edge of interface surface 14a.

[0025] Identification projection 17 that indicates an AC adapter is located near the lower edge of interface surface 14a at a position different from that of identification projection 12 for battery 3.

[0026] The coupling surface with aforementioned battery 3 or AC adapter 4 is formed on the rear surface 1a of projector device 1, as shown in Figure 3, with a pair of charging terminals 18, 18 installed near the upper edge. A plurality of depressions 19, 19 are formed in a line near the lower edge.

[0027] In short, power-supply terminals 11, 11 or power-supply terminals 16, 16 of battery 3 or AC adapter 4 are separately connected to charging terminals 18, 18 when adapter unit 14 of battery 3 or of AC adapter 4 is attached to rear surface 1a of projector device 1, and identification projection 12 or 17 is fitted to its corresponding depressions 19, 19.

[0028] The arrangement of depressions 19, 19, for example, would

be such that the identification projection for the battery having the greatest capacity would engage the rightward-most depression when viewed from the rear surface of projector device 1, and identification projections for batteries of decreasing capacity would engage sequentially toward the left, with the identification projection for AC adapter 4 engaging at the leftward-most position.

[0029] When an identification projection engages a depression, as shown in Figure 5, the contact points of detection switch 20 mounted within projector device 1 are closed, and the resulting detection signal allows projector device 1 to determine if a battery is attached or the AC adapter is attached, and also to determine the capacity.

[0030] Detection switch 20, which may be set in depressions 19, 19, is structured such that the contacts are closed by movable tab 21 which contacts connection tab 22 through compression by identification projection 12 or 17.

[0031] The type of battery or connection of AC adapter 4 can be distinguished in aforementioned method by the on/off state of the detection switch.

[0032] Magnetic or electrical techniques can be used to detect the type of battery or connection of AC adapter 4.

[0033] As shown in Figure 6, magnetic memory 23 made of magnetic material is attached to the coupling surface of battery 3A, and differentiation as to whether a battery or an AC adapter is attached to projector device 1 as well as the capacity can be made by reading of the recorded information by magnetic head 24 that is installed in projector device 1.

[0034] Otherwise, conductor 25 is attached to the connection surface of battery 3B and the positive terminal electrode of charging terminals 26, 26 is connected thereto, as shown in Figure 7. Electrode plate 27 that pairs with conductor 25 is installed in projector device 1 and the distribution capacity (termed "CO") of the capacitor formed between the two may be detected.

[0035] In short, the change in frequency of the output pulse of oscillator 28 is recovered as the change in output voltage v by the parallel circuit between capacitor 29 and inductor 30, by drive transistor 31, and by the following-stage rectifier circuit 32 (comprising a diode and capacitor), thereby readily allowing detection of the type of battery or connection of AC adapter 4, since the resonance frequency is altered by the CO when this capacitor is connected to oscillator 28 as shown in Figure 8 (a). A conductor having the distribution capacity unique to the coupling surface of the battery or AC adapter may be attached.

[0036] Figure 8 (b) shows the relation between the oscillation frequency f of oscillator 28 and the output voltage v. It is represented by the graph curve g having a peak value in the center and expansion to both sides.

[0037] The control of each of the switches 7, 7 by switching control unit 8 is explained next.

[0038] As mentioned above, switching control unit 8 controls lamp ignition commensurate with the capacity of the battery or AC adapter that is connected to projector device 1 in accordance with the signal

from power-source input detection unit 2. Accordingly, the number of lamps used is specified as a function of the power-source capacity or all lamps are used through PWM control, thereby controlling the brightness.

[0039] Since the first case, the number of lamps, is simply specified by on/off of switches 7, 7, the latter control method is explained below.

[0040] Switches 7, 7 adopt a structure of switching control of drive transistors 34, 34 of relay coils 33b, 33b using contact points 33a, 33a of relays 33, 33, as shown in Figure 9, but ignition control of the lamps using FET shown in Figure 10 is explained.

[0041] Switching control unit 8 shown in Figure 10 comprises oscillation unit 35, PWM control unit 36, delay circuits 37, 37, and FET drive circuits 38, 38.

[0042] In short, the output pulse of oscillation unit 35 is sent to PWM control unit 36 and then directly or via delay circuits 37, 37 to FET drive circuits 38, 38. PWM control unit 36 generates a signal having a pulse width in response to the detection signal from power-source input detection unit 2 and provides it to delay circuits 37, 37 and to FET drive circuit 38.

[0043] Thus, N channel FET 39, 39 are controlled on/off by control signals from FET drive circuits 38, 38, and the ignition of lamps 6, 6 is controlled through sequential switching.

[0044] For example, two lamps 6_1, 6_2 are installed and two N channel FET 39_1, 39_2 are installed to control ignition of these lamps, as shown in Figure 11 (a).

[0045] The consumed power and backlight brightness are maximized when these N channel FET 39_1, 39_2 are both turned on by control signals (these are termed "S1" and "S2) sent to N channel FET 39_1, 39_2 from switching control unit 8. The power consumption is halved and the backlight brightness darkens when control signals S1, S2 are in a phase relation that has shifted in the chronological axial direction by 1/2 of period T at 50% duty cycle of control signals S1, S2, as shown in Figure 11 (b).

[0046] The width of the on period of the control signal is altered as a function of the power-source capacity in this manner. In short, the power consumption would decrease if illumination is controlled so that the duty cycle of the control signals diminishes as the power-source capacity decreases, and power could be reserved to the extent that the brightness of the backlight falls. Thus, projector device 1 could be run for a comparatively prolonged period of time even if a battery having a small capacity were used.

[0047] In other words, battery consumption could be reduced if we are not averse to the sacrifice of reduced backlight brightness.

[0048] Furthermore, the aforementioned structure eliminates the disadvantage of ignition of only specific lamps, compared to the method in which the number of lamps is controlled, and that allows even wear of the lamps since all are used.

[0049] Therefore, a common lamp ignition circuit can be used in various types of projector devices having a common circuit structure with different power-source capacities, and lamp ignition can be

controlled in response to differences in the power-source capacity.

[0050] An ignition system using two lamps was exemplified in the explanation using Figure 11 for convenience, but such a circuit structure can be applied to a system using a plurality of lamps as well.

[0051] Moreover, the problem of flickering can be eliminated by raising the switching frequency of the FET and the delay circuit can be eliminated in certain circumstances.

[0052]

[Effects of Invention] As explained above, since the lamp power in a projector device is controlled commensurate with the capacity of the power source in the present invention, an image can be projected with a bright backlight when a power source having excess capacity is available when using a projector device indoors, while the unit can be controlled so as to inhibit power consumption by limiting the brightness of the backlight when running it off a battery having low capacity and little reserve power, thereby reducing battery consumption and prolonging the operating duration of the projector device.

[Brief Description of Drawings]

[Figure 1] A block diagram showing the principal parts of the projector device pursuant to the present invention.

[Figure 2] A circuit diagram for explaining operation of the projector device pursuant to the present invention. (a) is a diagram showing the state in which all lamps are ignited while (b) is a diagram showing the state in which only one lamp is ignited.

[Figure 3] A perspective view showing each coupling surface of the battery and projector device.

[Figure 4] A perspective view of the AC adapter.

[Figure 5] A general view for explaining detection of the power source and connection of the battery and the projector device.

[Figure 6] An explanatory figure of detection of the battery or AC adapter using magnetic memory.

[Figure 7] A diagram for explaining detection of a battery or AC adapter using electrostatic capacitance change. (a) is a perspective view showing the battery, (b) is a general view showing the connection state of the battery and the projector device.

[Figure 8] (a) A circuit diagram showing an example of a circuit that detects changes in the electrostatic capacitance. (b) A block diagram roughly showing the relation between the frequency and the detection voltage.

[Figure 9] A circuit diagram showing an example of a structure using a relay in the lamp ignition control unit.

[Figure 10] A block diagram showing an example of a structure of the lamp ignition control unit based on PWM control.

[Figure 11] A diagram for explaining ignition control of lamps based on PWM control. (a) circuit diagram, (b) wave form chart.

[Explanation of Notations]

1 projector device 1
2 power-source input detection unit 2
3 battery 3

3A, 3B batteries
4 AC adapter 4
6 lamp
7 switch means
8 control means

Figure 1

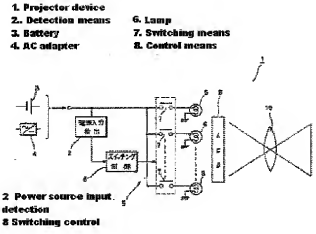


Figure 2

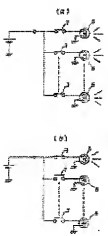


Figure 3

1 projector device
3 battery

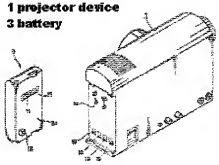


Figure 4

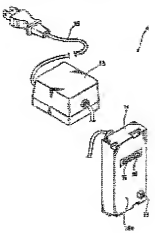


Figure 5

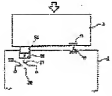


Figure 6

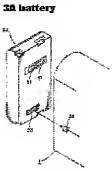


Figure 9

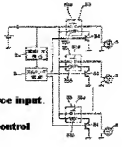


Figure 11

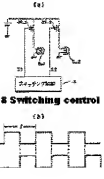


Figure 7

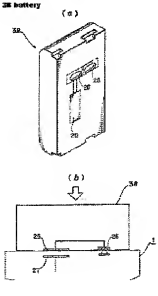


Figure 8

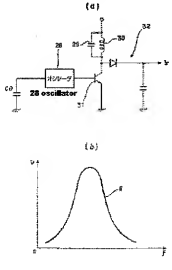
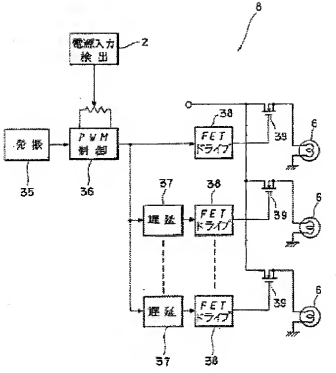


Figure 10



2 power-source input detection
35 oscillation
36 PWM control
37 delay
38 FET drive

CERTIFICATION OF TRANSLATION

The undersigned, Richard Patner, whose address is 26357 Lexington Drive, Bonita Springs, FL. 34135, United States of America, declares and states as follows:

I am well acquainted with the English and Japanese languages; I have in the past translated numerous Japanese documents of legal and/or technical content into English.

I have been requested to translate into English the Japanese Patent numbered 5-113604 entitled **"Projector Device "**.

To a copy of this Japanese document I therefore attach my English translation and Certification of Translation.

I hereby certify that the English translation of the attached document labeled **"Projector Device"** is, to the best of my knowledge and ability, an accurate translation.

And I declare further that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, and that false statements and the like are punishable by fine and imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

December 20, 2006
Date

Richard Patner